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No. 909.

THE ANTECEDENTS OF THE SEPTIC TANK.

By Leonard Metcalf, Assoc. M. Am. Soc. C. E.

Presented September 25th, 1901.

WITH DISCUSSION.

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Certain well-defined principles are already recognized and generally accepted; for the rest, it is as is to be expected in any new science, for theories and misconceptions multiply as do the applications to new and untried conditions.

It is not, however, of the principles of the bacterial and septic tank treatment of sewage that the writer purposes to treat, but rather of its evolution and of the antecedents of the so-called septic tank in their bearing upon and relation to the collateral patent question and the very broad and far-reaching claims being made in certain cases under them. Indeed, the writer's attention was first drawn to this subject by the claims—in his judgment unwarranted—for infringe-

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ment of patent rights in the construction of a sewage disposal plant designed by him for a large manufacturing company in New England. Since that time various claims for infringement in recently designed or constructed works have been made in different parts of the country, which has led the writer to present at this time a portion of the data gathered by him in his own studies, in the hope that it may be of some service to brother engineers.

Historical Sketch of Sewage Disposal Methods.

One is surprised to note of how comparatively recent origin are the various methods of sewage disposal other than the old privy and cesspool systems, which were frequently combined with agricultural disposal of the wastes. Indeed, most of the systems have been developed since the middle of the nineteenth century.

The privy was followed by the pail system and the cesspool; and then the cesspool from which the settled liquid was decanted to the sewers or upon land.

Next came the water-carriage system and the bitter war between the advocates of the *tout à l'égout*, and those advocating the primary separation of the solids before discharge into the sewer. About this time the Liernur system was also more or less in vogue in certain parts of the Continent, though it never gained much recognition in Great Britain.

Chemical precipitation was next developed, along, and in many cases combined, with sand filtration and broad irrigation; then storage and intermittent filtration, so carefully studied by the Massachusetts State Board of Health; and finally, within the last decade, the bacterial treatment of sewage, under which may be included the septic tank system; the septic tank system followed by intermittent filtration; the contact bed system—single, double or treble—and the various bacterial methods making use of the principles of bacterial contact in diverse ways, with or without such minor modifications as primary sedimentation, passing through roughing-filters or strainers, aeration, etc.

In London,* for instance, cesspools were in general use until 1847; thereafter, water-closets, with a sewerage system discharging directly

* "Public Health and Its Applications in Different European Countries," by Albert Palmberg, M.D., translated from the French by Arthur Newsholme, M.D. 1893. Also *Minutes of Proceedings*, Institution of Civil Engineers.

into the Thames, until 1859, when Bazalgette's plan was adopted and put under way. It was not until 1865, however, that the latter system was finished in its essential parts—comprising an intercepting sewer with storage tanks, discharging on the ebb-tide only—while the intercepting sewer on the north side of the Thames was not begun until ten years later.

So, too, in Paris, the water-carriage system, with final disposal of the sewage by irrigation, was very slow in gaining general favor. Probably nowhere was the cesspool or tank system so carefully studied and fully developed as at Paris, for which reason it may be of advantage here to allude to its various steps a little more fully.

In 1820, Paris* "made the fatal mistake of insisting, by ordinance, upon the use of cesspools," and for twenty years thereafter such sewers as were built received only the decanted liquid or overflow from these cesspools. As late as 1854, the Prefect of the Seine† presented a memoir suggesting two possible methods of sewage disposal for Paris. The first, for a system of sewers to carry the solids and liquids to a distant point for treatment; the second, for the retention of the solids and the discharge of the liquid only into the sewers. The latter method was adopted, and the execution of the plans was begun in 1867. "Hardly had the collectors and the network of sewers begun to spread, under the direction of Belgrand, than the *tinettes filtrantes* were put into use," say MM. Bechmann and Launay in their valuable paper on "L'État Actuel de l'Assainissement de Paris."‡

These various devices for separating the solid from the liquid portion of the wastes are interestingly described by M. A. Mille,§ the *fosses fixes*, from which the matter is raised by metallic vessels or vacuum pumps; the *fosses sèches*, used in the barracks; the *tinettes filtres* or *filtrantes*, which permit the liquids to escape, and reduce the refuse to one-fifth part; the *vidange automatique*, invented by M. Mouras to do away with the necessity for even periodic removal of the solids; and all those other devices for dividing or diluting the sewage, which did so much to delay the adoption of the water-carriage system.

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* *Minutes of Proceedings*, Institution of Civil Engineers, Vol. xxiv, p. 318. R. Rawlinson.

† "Assainissement des Égouts et des Habitations," par Eugéne Miotat, Architecte Expert, 1881, p. 14.

‡ *Annales des Ponts et Chausées*, Jan.-June, 1895, pp. 257-327.

§ "Assainissement des Villes par L'Eau, Les Égouts, Les Irrigations," par M. A. Mille; and "Fosses d'Aisances, Latrines, Urinoirs, et Vidanges. Historique, Construction," etc. F. Liger, 1875.

The very general use of these devices is indicated by the fact* that:

"There are (1878) about 70 000 houses in Paris, of which only 62 000 are registered as having some description of night-soil service. These comprise four systems:

	Number.
"*First.*—Water-tight cesspools built in masonry.....	86 000
Second.—Removable receptacles (*fosses mobiles ordinaires*), or wooden barrels.....	17 450
Third.—Movable receptacles (*appareils diviseurs*), in which the liquid portion only filters into the cesspools, having no connection with the sewer.....	10 770
Fourth.—Movable receptacles (*tinettes filtres*), in which the liquid portion only filters into the sewers.....	10 000
	124 220"

In 1880, however, in consequence of the experiments upon the purification of sewage, began at Clichy, by MM. Mille and A. Durande-Claye in 1868, and carried on by them with such signal success, and when the use of the *tinettes filtrantes* had been more or less proscribed, "the administration proposed the discharge of all sewage direct into the sewers, and the abolition of all fixed or movable cesspools."† This was adopted in the session of June 23d, 1880, and "the law contained in it the germs of the principles which were finally consecrated in the law of July 10th, 1884."

About this time the Technical Commission of 1882, on the Drainage of Paris, condemned the use of the various devices for separating the solid from the liquid portion of the sewage, and advocated the *tout à l'égout* system.

"The Commission did not admit that it was ever necessary to keep in the house a place where the products of daily life could ferment," and therefore expressed itself as seeing "in these last efforts, which aim to simplify the *fosses fixes*, the hypocrisy of the *tout à l'égout* without its advantages. They take nothing from the underground flow, and, when all is said, do not avoid the deposits in the cesspools."‡

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* *Minutes of Proceedings*, Institution of Civil Engineers, Vol. liii, 1878, p. 201; "On the Main Drainage of Paris and the Utilisation of its Sewage," by Felix Target.

† "L'État Actuel de l'Assainissement de Paris," par MM. Bechmann et Launay pp. 257–327, in *Annales des Ponts et Chaussées*, Jan.–June, 1895.

‡ See also *Annales des Ponts et Chaussées*, July, 1885; "Commission Technique de l'Assainissement de Paris," par M. A. Durande-Claye.

See also "Assainissement des Villes par L'Eau, Les Égouts, et Irrigations," par M. A. Mille.

Nevertheless, these devices appear to have served their purpose economically and efficiently for a considerable period of years, as is indicated by the remarks of so able an engineer as M. A. Durande-Claye, who, in an address, before the International Congress of Hygiene at Geneva, upon "Vidanges et Égouts," said of the *fosses fixes*, "In spite of its imperfections and dangers, it was indeed a step in advance of the barbaric depots of antiquity and the middle ages."

On February 28th, 1887, a law was passed providing for turning all matter directly into the public sewers within certain limited districts, with certain restrictions.

In 1886 a commission was appointed to investigate foreign methods of sewage disposal, and on April 4th, 1889, was passed the act authorizing the purchase of land at Achères for irrigation purposes. Nothing definite was done, however, toward securing the direct discharge of household wastes into the sewers until the cholera epidemic of 1892, which again awakened public interest, and culminated in the passage of the act of July 10th, 1894. This act, say MM. Bechmann and Launay, "constitutes one of the most important acts in the history of Paris and the science of hygiene, and provided for the modern Paris sewage disposal plant."*

It will thus be seen that the water-carriage system and purification by irrigation were not adopted for general use in Paris until near the close of the last century.

To the student of septic tank sewage treatment, this long period of use and development of the *fosses* in Paris is full of significance and interest.

General Claims.

Turning now from the broad question of methods of sewage disposal, let us glance at some of the specific claims of novelty bearing upon the bacterial, and more particularly the so-called septic, treatment of sewage, recently advanced.

Claims are made for the discovery, or at least for novelty in the application, of the following principles:

Sedimentation; septic or anaerobic bacterial action and the conditions

* See *Annales des Ponts et Chaussées*, January, 1895, previously referred to.
Also "Les Travaux Souterrains de Paris," 1810-1878, par Eugène Belgrand, Vol. 5.
Also works of MM. A. Durande-Claye, and Eugène Miotat, previously referred to.
Also "Les Systèmes d'Evacuation des Eaux et Immondices d'une Ville," par C. von Overbeck de Meijer.

developing and fostering it; aerobic bacterial action; slow flow through long tanks and the greater uniformity in character of sewage resulting therefrom; alternate use of settling, decanting or bacterial tanks, or beds filled with certain materials; periods of contact or activity, rest and recuperation; rapid screening through coarse materials; aeration; and doubtless many others.

While, under the devices, novelty is claimed in the use of: Covered, as distinct from uncovered, tanks; artificial ventilation by chimney or otherwise; special shape and grouping of tanks; form of bottom; submerged inlet and outlet; barriers and baffle-boards; aerating weirs or steps; and many alternating devices for manipulating gates, regulating period of inflow, contact, discharge and aeration of the beds, etc.

Discussion of Claims.

Few engineers would dispute the statement that the bacterial purification of sewage is far better understood to-day than it was a generation ago; yet many—if not a majority—of the engineers who have studied the question, would be unwilling to allow the claim of novelty in the action which is produced in the septic tank. This action is essentially a natural one, a process of Nature, which it is certainly difficult, if not impossible, to prevent, under the normal conditions attending storage or sedimentation of sewage.

The essential difference between the old cesspool and the modern septic tank appears to consist in the period of contact of the fresh or stale sewage with the liquefying action of the anaerobic bacteria developed and contained in the tank.

In the first cesspools, this period of contact was determined by the frequency of emptying them; in the later ones, provided with an overflow, by their relative content as compared with the volume of sewage to be disposed of. The later cesspools, therefore—as, for instance, those consisting of a water-tight chamber discharging its overflow into a sewer, leaching cesspool or sub-surface irrigation system—did not differ essentially, in principle at least, from the modern septic tank; for, according to the present theory, a limited anaerobic action only is desired, sufficient to bring about the hydrolysis of the solids, fats and soaps by the bacteria or their enzymes, as Professor Kinnicutt has suggested.

Beyond this stage of liquefaction, it is apparently undesirable to go, for prolonged contact results in the formation of bacterial wastes or poisons, making the further purification of the sewage by subsequent nitrification more difficult, or, if subsequent purification is unnecessary, the effluent is at least much more offensive and perhaps likely to undergo secondary putrefaction when disposed of by dilution.

The bacterial liquefaction of the organic matter in sewage may not have been fully understood, but fermentation, maceration and bacterial putrefaction were well known upwards of fifteen or twenty years ago.

Thus the Mouras's Automatic Scavenger, hereafter referred to, was described by Abbé Moigno,* who believed that in the liquefaction of the organic matter, "The solvent action of sulphuretted hydrogen is called into play, and that a species of putrid fermentation is set up, which effects the liquefaction of the solid fæces," while the abstractor closes with the suggestion, "May not the unseen agents be those vibrions or anaerobies which, according to Pasteur, are destroyed by oxygen, and only manifest their activity in vessels from which the air is excluded?"

In 1883 the late Edward S. Philbrick, M. Am. Soc. C. E., of Boston, in an interesting article in *The Engineering Record*,† upon the Disposal of Sewage by Sub-surface Irrigation, suggested the use of "a tank or tight cesspool in which the solid particles of the sewage may become macerated and finely divided by fermentation before entering the distribution pipes."

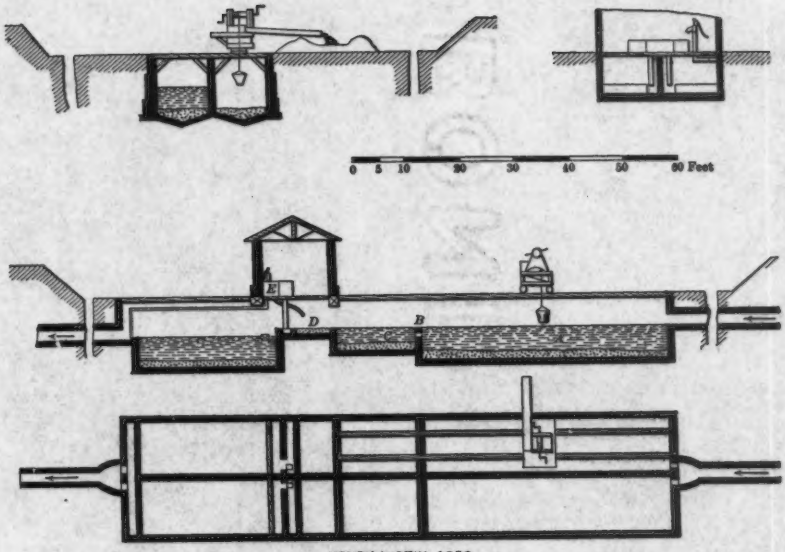
In 1887 Mr. Dibdin, in a paper on Sewage Precipitation delivered before the Institution of Civil Engineers, observed that:

"One object claimed for the use of an excessive quantity of lime, and also for some other substances, is that they destroyed the living organized bodies, such as bacteria, etc., which give rise to the phenomena known as putrefaction. * * * As the very essence of sewage purification is the ultimate destruction, or resolution into other combinations, of the undesirable matters, it is evident that an antiseptic process is the very reverse of the object to be aimed at," and he further remarked that, "Very alkaline effluents, such as those produced by the use of lime in excessive quantities, are very liable to putrefy instead of becoming purified by oxidizing organisms."

As regards sedimentation by slow flow through long tanks, and the

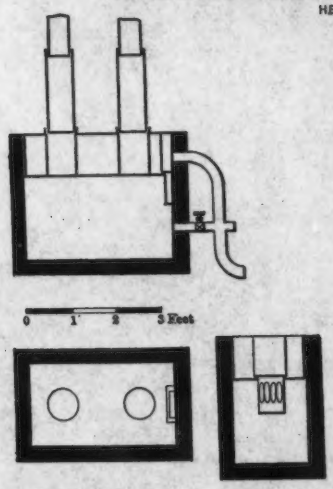
* *Cosmos les Mondes*, December, 1881, and January, 1882.

† *The Engineering Record*, May 10th, 1883, p. 530.



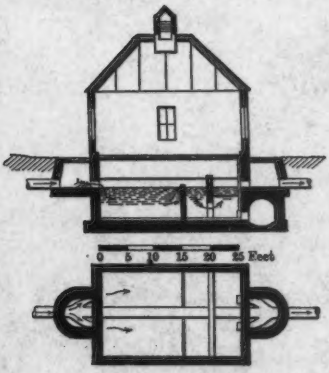
HENRY AUSTIN, 1852.

FIG. 1.



OF. L. PAGLIANI, ROME, ITALY, 1884, 1891.

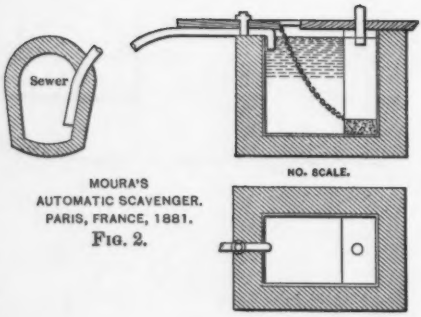
FIG. 7.



MARLBORO, MASS., 1892.

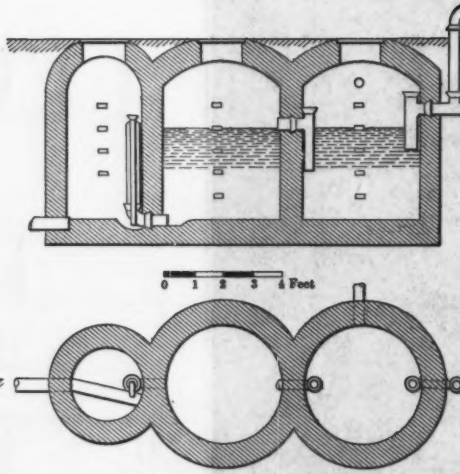
FIG. 8.

WELLESLEY



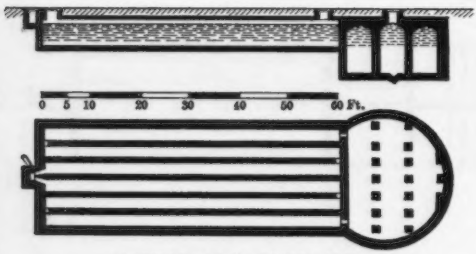
MOURA'S
AUTOMATIC SCAVENGER.
PARIS, FRANCE, 1881.

FIG. 2.



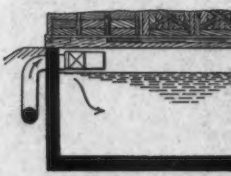
EDWARD S. PHILBRICK, BOSTON, MASS., 1883.

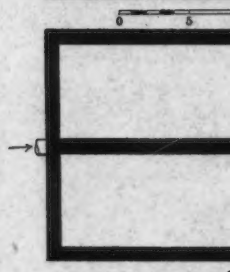
FIG. 4.

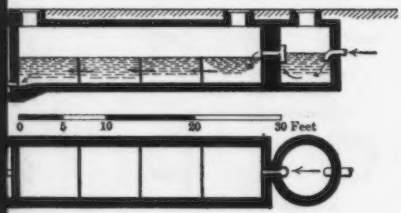


LAWRENCEVILLE, N.J. SCHOOL, 1882.

FIG. 3.

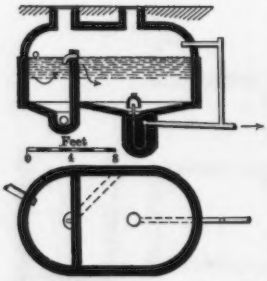






ELLESLEY COLLEGE, WELLESLEY, MASS., 1892.

FIG. 9.

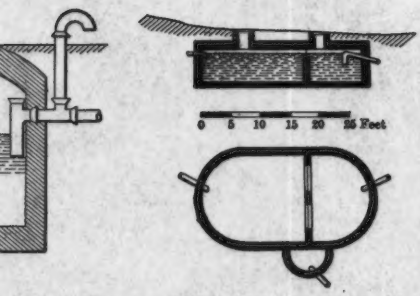


MASS., AGRICULTURAL COLLEGE, 1892.

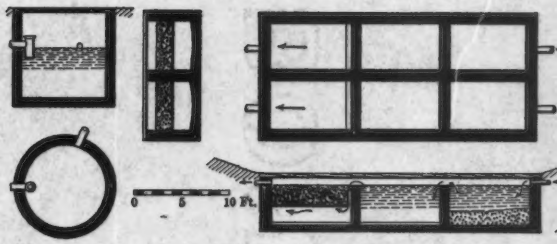
FIG. 10.

GARDNER, MASS

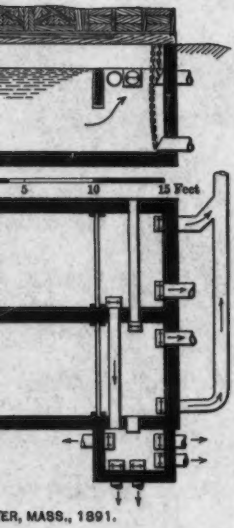
FIG. 11.



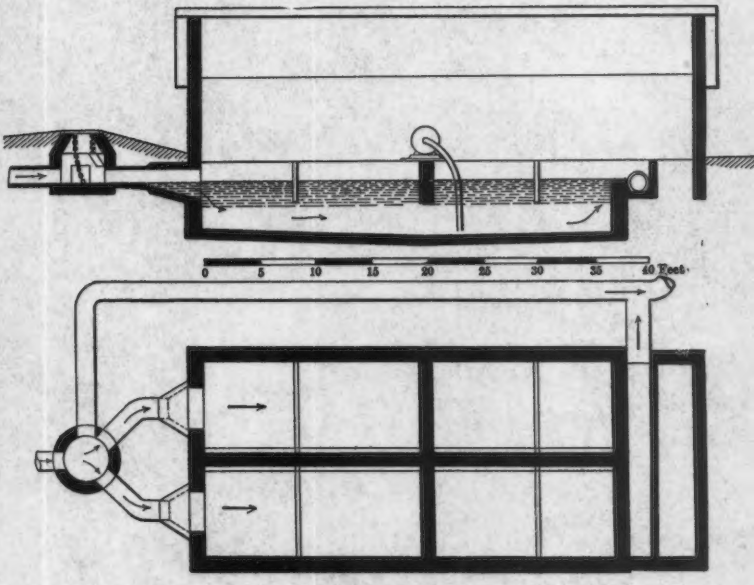
STATE HOSPITAL FOR THE INSANE.
WORCESTER, MASS., 1876.
FIG. 5.



MEDFIELD, MASS., 1886.
FIG. 6.



ER, MASS., 1891.
FIG. 11.



CHAMPAIGN, ILLINOIS, 1897.
FIG. 12.

greater uniformity of the sewage resulting therefrom, the use of baffle-boards, deflecting walls, etc., the principles involved have long been known and made use of—particularly in chemical precipitation systems.

Thus, taking several examples at random, Mr. Henry Austin,* in his interesting preliminary "Report of the Means of Deodorizing and Utilizing the Sewage of Towns," suggested means (see Plate XI, Fig. 1), for more effectually "separating the solid portion of the sewage from the water in which it is conveyed."

Professor H. Tanner, in his discussion of the valuable paper by Mr. Bazalgette upon "The Sewage Question," says:†

"* * * the engineer, by suitable mechanical arrangements, could go far in the direction of separating from the sewage the solid matter which it contained, and he could thereby greatly lessen the area of land which would otherwise be necessary. And here he would draw attention to the importance of constructing sewage tanks so as to facilitate the subsidence of the solid matter of the sewage, and to one modification which he had found successful. Tanks constructed for subsidence purposes should provide for the sewage passing through with the least possible agitation to the bulk of sewage which was there depositing its solid matter. By constructing a barrier across the tank, at the same level as the overflow at the opposite end, thereby forming a small preliminary compartment, the force of the current was kept within that portion of the tank, and the passage over such barrier displaced an equal volume quietly at the overflow outlet. This might be assisted by additional barriers, some raised from the bottom of the tanks, some pendant and sinking into the water for a depth of from 6 to 10 ins. Tanks thus constructed at the sewage works at Barking were fully equal to three times as much work as they had previously done. By these and similar arrangements which enabled the sewage to remain tranquil whilst subsidence was proceeding, it was possible, by mechanical arrangements, to accomplish much which would otherwise devolve upon the land. * * *."

And many other writers, as Mr. Philbrick, in 1883, have referred to the effect of tanks in "equalizing the flow of sewage."

Precedents abound for the use of roofs or covers, as well as of artificial means either for producing or preventing the free circulation of air in sewage tanks. Climatic conditions, proximity to dwellings, convenience, etc., are likely to be the controlling factors in their use

* London Sewer Reports, 1857, p. 79.

† *Minutes of Proceedings*, Institution Civil Engineers, Vol. xlix, p. 181, April, 1877, discussing C. N. Bazalgette's paper in *Minutes of Proceedings*, Institution of Civil Engineers, Vol. xlviii, pp. 143-248, Feb. 6th, 1877.

or disuse, as investigation has seemed to indicate that the bacterial (surface) mat is itself efficient as an excluder of light and air.

The value of baffle-boards and barriers, submerged inlets and outlets, in securing a slow and regular flow through, and preventing the formation of agitating currents in, sewage tanks, has already been referred to under the head of sedimentation, and some specific examples of their use are given in the following pages.

Space forbids an extended discussion of the validity of other claims mentioned, but, doubtless, certain of the devices for manipulating the beds and their appurtenances are novel in application, if not in form.

Illustrations and Precedents.

The following examples, arranged in chronological order, which have come to the writer in the course of his study of the subject, are given as illustrative merely of the principles alluded to, but without any idea of their being complete, or even perhaps the best examples on record. They have been drawn from text books and the many engineering journals within reach of the engineer, and published in this country, in England and in France. Time has, unfortunately, prevented a search of continental publications other than those of the French societies.

*Henry Austin's Parliamentary Report, 1852.**—In an interesting report upon the sewerage of towns, Mr. Henry Austin, of London, then Chief Superintending Inspector of the Board of Health, made some interesting recommendations for "An arrangement for separating the solid portion of the sewage from the matter in which it is conveyed, * * * with a view to the more efficient and economical working of the process;" that is, for primary sedimentation before treatment with lime and filtration.

"The great bulk of the solid matter, when the sewage comes to comparative rest in the reservoir, divides itself into two bodies; the heavier particles at once deposit themselves at the bottom, and the lighter portions collect, in a solid floating mass, on the surface. It appears to me that the chief proportion of these matters may be intercepted in the first tank, *A*, both above and below, without a filter, by a simple division, *B*, with basketwork and perforated boards in the

* "Report on the Means of Deodorizing and Utilizing the Sewage of Towns." Addressed to the Rt. Hon. The President of the General Board of Health, Hon. William Monsell, M. P., by Henry Austin, C. E., London, 1857. Presented to both Houses of Parliament.

middle, allowing the water to pass through only at a certain depth beneath the surface.

"The second tank or reservoir, *C*, need not then be so deep or so large as the first. At the end of it, filtering materials of different kinds should be arranged, through which the sewage would pass laterally; 1st, coarse screened gravel, beach or broken stones; 2d, gravel of medium coarseness; and 3d, some finer material. And there would be much advantage in having this filter, *D*, shallow and broad, rather than deep and narrow; the surface water only would pass away, and thus allow of further deposit from the main body before filtration; it would be subject to greater friction and disengagement of the solid matter and foul gases; and the filtering medium itself would be less readily clogged and would be more accessible for cleansing without removal, as it could be turned over in its place and subjected to complete washing, from a water tank, *E*, above, as often as desired. A very small area of filter so placed would be found sufficient for all practical purposes. * * *

"It is stated as one of the results of the Manchester experiments, that the lime falls at the rate of 1½ ins. per minute. The admixture being made as the sewage flows into the reservoir at each side. I propose that it should be intercepted by a fender, that it may not disturb the main body of water, and that the discharge to the outfall should take place over a weir, allowing only a surface film of the water, from which the lime has descended, to pass over.

"The depth of this surface water passing over, and the length of the reservoir, must be, of course, determined by the quantity which has to be discharged.

"The construction shown on the plans would be sufficient for a town of about 3 000 inhabitants, and would probably cost from £250 to £300, exclusive of the excavation of the site and the fencing shown, which would depend upon locality."

School Cesspool, Derbyshire, 1858.—Dr. Samuel Rideal, in the Cantor Lectures,* on the "Bacterial Purification of Sewage," delivered in 1899, mentions the time and skill spent by architects and others upon the design of cesspools in England in the early Victorian period, when sanitary progress first drew attention to its importance; and he refers to the construction in 1858 of a very large cemented brick pit for a school in Derbyshire, into which passed continuously the sewage of 250 to 300 persons, and the drainage from a farm. Whenever the pit was full its contents were pumped out from a point near the bottom and discharged by pipes over cultivated slopes. The mixed water was said to be clear and bright, except for an occasional turbidity from

*Journal, Society of Arts, London, January 16th, 1899, p. 688.

the clay. At the periods of emptying, no nuisance occurred, though sometimes a faint odor was noticed when the wind was in the right direction.

*Settling Tank at Hospital for the Insane, Worcester, Mass., 1876.**—This settling tank (shown in Fig. 5, Plate XI), designed for an ultimate capacity of 600 persons, is of particular interest, as making use of the submerged inlet and outlet, diaphragm wall with punched screens and screen weirs, and the masonry roof. It forms a part of the broad irrigation system in use there.

Mouras' Vidange Automatique, 1881.—Mouras' Automatic Scavenger has been so frequently referred to and discussed in recent engineering literature as to make it unnecessary here to do more than give a few references† to it and briefly outline its action.

The scavenger was described by Abbé Moigno, editor of the *Cosmos les Mondes* as being a metal receptacle, hermetically sealed, continuous in working, absolutely inodorous, which rapidly transforms all it receives into a homogeneous fluid, only slightly turbid, free from deposit of any kind, and almost devoid of smell. Its general arrangement is shown in Plate XI, Fig. 2, and needs no further comment.

An interesting account of the application of the scavenger is given in the *Minutes of Proceedings* of the Institute of Civil Engineers, Vol. LXVIII, page 502, 1883–84. According to this, the scavenger was placed at the works of Mr. Herzog at Logelbach in the middle of the year 1883. It had a capacity of about 16 800 U. S. galls., and was used for three water-closets frequented by 150 people, the inflow being fairly constant in volume. The inlet and outlet pipes were submerged, of the form prescribed by the inventor, by which the vessel was hermetically sealed and the phenomena of oxidation practically prevented. The author states that complete putrefaction took place, by which all solid matters were dissolved in the space of thirty days.

Professor Rideal, commenting upon the size of the tank, says:

"It is not so large as to be impossible with ordinary sewages, but

* Rafter and Baker's "Sewage Disposal in the United States," p. 456.

† *Cosmos les Mondes*, December, 1881, January, 1882, and January, 1883.
Minutes of Proceedings, Institution of Civil Engineers, Foreign Abstracts: Vol. lxviii, pp. 350–352, 1881–82; Vol. lxxii, p. 359, 1882–83; Vol. lxviii, p. 502. 1883–84.
"Assainissement des Villes par l'Eau, les Egouts, les Irrigations," par M. A. Mille.
"Sewage and the Bacterial Purification of Sewage." By Dr. Samuel Rideal. p. 165.
Journal, Society of Arts, London. p. 710. 1899. Abstract by Rudolph Hering, M. Am. Soc. C. E.
Journal, Association of Engineering Societies, Vol. xxiv, February, 1900. Article on the Septic Tank, by Professor Leonard P. Kinnicutt.
Engineering News, April 15th, 1882, and reprint of the same, accompanied with letter of Kenneth Allen, M. Am. Soc. C. E., May 12th, 1898.

the fact that the effluent from such a tank was not sufficiently purified without further nitrification, prevented the automatic scavenger from being more generally adopted."

It appears to have been used for some years, however, in Paris, until the passage of the act requiring the discharge of all sewage direct into the mains, without preliminary treatment of any kind.

Mouras' scavenger is also described in a letter* by Scott Moncreiff, in which he says, referring to the later septic tank of Donald Cameron:

"It is nothing new, and has been in use by Beazley and Burrows, Architects, of Victoria Street, Westminster, for the last seven or eight years, in their ordinary practice of draining country houses."

School for Boys, Lawrenceville, New Jersey, 1882.†—A double receiving and settling tank (Fig. 3, Plate XI) for use at Lawrenceville, N. J., in conjunction with a sub-surface irrigation system, was designed in 1882 by J. James R. Croes, President, Am. Soc. C. E. Its capacity was planned for 400 persons, though it was used by only 180 for some time. The sewage at first amounted to about 6 000 galls. per 24 hours, though later, in 1893, it reached 20 000 galls. per 24 hours. The joint capacity of the two chambers amounted to about 11 000 U. S. galls. The sewage flowed in each septic tank down through one long central passage-way, back through the next, and out through the outside passage into the pump well, from which it was periodically discharged by a pulsometer pump into a sub-surface irrigation system. The inlets and outlets between the chambers were submerged, with a weir at the end of the last channel, over which the sewage fell in a thin sheet into the pump-well below. The chambers were ventilated by a flue to the boiler house.

This plant, built in 1882, embodied to a striking degree the very processes and devices now being used by others under claim of novelty, and covered by recent patents.

Massachusetts Reformatory, Concord, Mass., 1883.‡—A sewage disposal system, comprising sedimentation, storage and broad irrigation, was designed for this institution by William Wheeler, M. Am. Soc. C. E., in 1883. This system is of interest as illustrating the use of a small sedimentation and macerating chamber for the separation and liquefaction of the solids, submerged inlets and outlets, a large

* *Engineering* (London), September 25th, 1896, p. 407.

† Rafter and Baker's "Sewage Disposal in the United States," p. 511.

‡ See Massachusetts Public Documents, 1883, No. 13. Also Rafter and Baker's "Sewage Disposal in the United States," pp. 468-475.

storage chamber to contain approximately 14 hours' night flow of sewage, from which the liquid was pumped daily to a point approximately 1 ft. from the bottom. The tanks were also covered with a masonry roof, and provided with artificial ventilation to the chimney.

Edward S. Philbrick, 1883.—In an interesting article* on "The Disposal of Sewage by Sub-Surface Irrigation in Suburban Residences," Mr. Philbrick suggested the advisability of sedimentation, maceration and intermittent application of the sewage in sub-surface irrigation systems, and described a tank for accomplishing this purpose. Its construction is so clearly shown in Fig. 4, Plate XI, as to make further description unnecessary. Mr. Philbrick's discussion of the operation of the tank previously alluded to is excellent. The use of similar tanks has also been suggested in the more recent works of the late Colonel George E. Waring, Jr., and Mr. William Paul Gerhard.

In a later article† Mr. Philbrick, replying to an open letter asking about the dimensions for a flush-tank and settling basin for a hospital containing twenty-five beds, suggested the use of tanks 5 ft. in diameter by 5 ft. in depth, which would have given approximately 8 or 10 hours' sedimentation and septic action.

Medfield, Mass., 1886.‡—The "settling and filtering tanks" shown in Fig. 6, Plate XI, were designed for the Town of Medfield, Mass., by Eliot C. Clark, M. Am. Soc. C. E.§

Professor L. Pagliani, 1891.—At the VIIth International Congress of Hygiene and Demography, held in London in 1891, L. Pagliani, Professor of Hygiene, and Director of the Public Health, at Rome, Italy, presented a paper on "The Application of a Reservoir Interceptor, made on the Type of Mouras' Fosse, and of a Peat Filter for Sewage in the System of Separate Sewerage."

In this, he says: Considerations of economy made the *tout à l'égout* system impossible, and compelled the adoption of "a good dividing system," which should "separate the soluble or emulsionable materials of the privy * * * from the solid and heavy parts," and thus make

* *The Engineering Record*, May 10th, 1883.

† *The Engineering Record*, Vol. 8, p. 444.

‡ Rafter and Baker's Sewage Disposal in the United States, pp. 490-493. Also *Engineering News*, and *The Engineering Record*.

§ A detailed description of these tanks may be found in *The Engineering Record* May 10th, 1883.

possible the use of small-sized sewer pipes without danger of clogging. The tank is a type of Mouras' scavenger, made of cast iron or cement, as shown in Fig. 7, Plate XI.

"Experience has proved that such a reservoir can work properly without any inconvenience for a very long period, and perhaps indefinitely, when to it is supplied an abundant flowing of water; but if the water be in want, it may happen that the floating layer thickens so in the course of a few months as to make difficult the further flowing of the successive sewage. In this case, however, to put the apparatus to work again is sufficient to draw off the reservoir some liquid at one-fourth its height from the bottom by means of a pipe; the surface of the liquid with its floating solid layer is thus lowered," and the trouble remedied by further dilution. No deposit occurs in the pipe system.

"To filter the dissolved sewage that is drawn from the reservoir I resorted to peat with the best results."

He then describes his and Professor Monari's experiments with peat as a filtering medium, and mentions several plants of this character designed by him, notably in Rome, Turin and Massa.*

Gardner, Mass.; Marlboro, Mass., 1892.—Figs. 11 and 8, Plate XI, illustrate the tanks at Gardner and Marlboro, Mass., for description of which the reader is referred to Rafter and Baker's "Sewage Disposal in the United States."

Wellesley College, Mass., 1892, and Massachusetts Agricultural College, Amherst, Mass., 1893.—Figs. 9 and 10, Plate XI, are of interest chiefly as illustrating certain types of tanks. The former discharges intermittently into sub-surface irrigation pipes; the latter upon irrigation beds.

Champaign, Ill., 1897.—In Fig. 12, Plate XI, is shown the Champaign, Ill., tank, designed by C. N. Talbot, M. Am. Soc. C. E. Of it, Professor Talbot says:†

"This septic tank has been in operation since 1897, although it was designed in 1895. It was an outgrowth of the writer's experience with the Urbana septic tank, which he constructed in 1894. The ideas for this came from a study of various settling tanks connected with sewage disposal works, the action of large cesspools, and the 'automatic vault cleaner' of M. Mouras, described in *Engineering News* of April 15th, 1882. The Urbana tank was covered with

* Since making the above abstract of Professor Pagliani's work, the writer has noticed a short article in *The Engineering Record* of March 30th, 1901, upon "An Early Example of Combined Septic Treatment and Filtration of Sewage."

† *Engineering News*, August 17th, 1899, p. 112.

plank and earth, and had a submerged outlet. Observation on its action proved that a material purification of the sewage was made, and the efficiency of the tank has been quite satisfactory. It may be noted that the development of the septic tank process in Urbana and Champaign was made at about the same time as that at Exeter, England, the two being entirely independent of each other, though along much the same lines. * * *

"It may be well to say that this system may be used without infringing on any patents. While a company claims to have a patent, the principles of darkness, non-ventilation, submerged outlet, and other features of the septic tank have been in use so long that they certainly are not patentable."

This brings us to the present period, and to the development of the modern septic tank and bacterial contact systems of sewage disposal. Some excellent and very suggestive studies have been made in this field within the last decade, and the actual processes of Nature are probably far better understood to-day than formerly. Many of the professedly new principles and devices used are covered by patents, both at home and abroad; yet a comparison of the actual methods used to-day with those of years ago, regardless of new interpretations or explanations of the forces involved, discredits at least some of the claims of novelty now being advanced.

Enough has been said, however, to indicate that the following processes and operations are old in application in the field of sewage disposal, and hence that their use, *per se*, cannot constitute an infringement of patent rights:

1.—Sedimentation, as shown by the work of Mr. Austin, Dr. Tanner, and many others referred to;

2.—Reduction and liquefaction of the solids, soaps and fats by bacterial or anaerobic action, hydrolysis, fermentation, maceration, etc., by slow passage of the sewage through a tank or chamber, as shown in the different types of tanks and modified cesspools used in Paris and the world over, the Mouras' automatic scavenger, Paglianl's tank, Philbrick's tank, Croes' Lawrenceville plant, Talbot's Urbana and Champaign tanks, the Amherst tank, and many others;

3.—Decantation of the liquid and liquefied portions of the sewage from the tank without disturbing its contents or the surface blanket or sludge deposit in the bottom, by means of the submerged outlets, as shown by the work of Mr. Austin, Dr. Tanner and others, Mouras'

automatic scavenger, Paglianl's tank, Philbrick's tank, Croes' tank, Wheeler's Massachusetts Reformatory tank, and many others cited;

4.—Hydraulic sealing or trapping by submerged inlet and outlet, as shown by numerous examples cited;

5.—Roof or covering, as shown by various examples cited;

6.—Artificial ventilation, as shown by certain of the tanks used in Paris, Wheeler's Massachusetts Reformatory storage chamber, Philbrick's tank, Croes' tank, and others;

7.—Absence of ventilation and exclusion of light and air, as in Mouras' automatic scavenger, Paglianl's tank, and others;

8.– Removal of the sludge without draining the tank, as in Paglianl's tank, the Amherst tank, and others;

9.—Overflow and aeration by weir, as shown in Austin's tank, Croes' Lawrenceville tank, and others;

10.—And many other processes and devices of lesser importance.

To discuss the recent work, however, is beyond the purpose of this paper. The writer has aimed only to present, to those interested in the subject, certain facts, gathered by him in his investigations, which seemed to have an important bearing upon some of the more recent claims for novelty, as well as upon certain old patents now being interpreted in the light of modern scientific development, and in a way never dreamed of by their authors.

DISCUSSION.

Mr. Snow. FRANK HERBERT SNOW, Assoc. M. Am. Soc. C. E.—The author is not the only engineer who has been bothered by claimants to proprietorship in the septic tank. If others have gone into painstaking research of the antecedents of this modern method, it is not known. Mr. Metcalf is the first to submit, in permanent form, for general reference, the results of such investigation, and his expressed hope that this effort may be of service to brother engineers interested in the patent question will undoubtedly be realized.

Modern proprietory methods of sewage disposal are demanding the attention of civil authorities. The septic tank is a modern method, in the sense that it was not recognized as a practical mode of treating a large volume of sewage until about six years ago. It is not a modern method in the sense that the action peculiar to sewage confined in receptacles has been known and observed for many years. The plans on Plate XI show tanks which were constructed for the purpose—as the speaker understands them—of intercepting the solids in the sewage, prior to subsequent treatment of the liquid. It has not been made clear what disposition of the sediment was intended. The advocates of the modern septic tank at first claimed complete liquefaction of the solids, but now modify this claim. That some such action did take place in the old tanks was known. Thus, not all the claims for the modern system are being realized, but, on the other hand, more has been accomplished by the old tanks than was expected or intended by their designers.

The speaker does not think for a moment that proprietary rights in the septic system need be a subject for serious apprehension, but he does consider the patent question a pertinent one, and will confine his remarks to a brief review of the subject as it has come to his knowledge since 1882, when he first became interested in sewage disposal.

The invention of systems of, and appliances for, treating sewage has more than kept pace with the actual development of the science of sewage purification. A great many inventions have been patented. Many of the patents issued are without doubt invalid, many of them are impracticable, and a few may meet a real need which is not universally felt at the present time, because the science has not sufficiently developed.

Mr. Metcalf has referred to patents which cover the subsequent treatment or disposal of the septic fluid, as well as those which refer to the septic tank itself, and the discussion may, therefore, properly take into consideration the aerobic and anaerobic processes.

The speaker has used the septic tank in combination with filters

for several years. Recently, he has had his attention called to the fact that claims for infringement of patent rights were about to be pressed in nine cases in which he is interested in the design and construction of sewage purification works. These claims are so broad that they appear at first to be ludicrous, and their attempted enforcement little less than blackmail; but, nevertheless, the fact of the mere notification of intention to sue is enough to arouse fear in the mind of the alleged infringer, and to place the designer of the plans in an unpleasant position before his client. Therefore, the patent question has forced itself upon some of the members of this Society, already, and it behooves others to consider their premises well before submitting plans for adoption. Mr. Snow.

Sewage left to its natural course will ultimately purify by the agency of chemical changes depending upon bacterial action. The early artificial methods of disposal, like chemical precipitation, were antiseptic in their operation, and inimical to bacterial life. At the present time the whole trend of thought and effort is to discover and meet the conditions which aid and intensify this life. After it was realized that the action could be accelerated by oxygen without the agency of vegetation, the use of sands, over which the sewage could be spread in thin films, thereby increasing the area of oxidation and bacterial action, and in which, by alternately applying sewage to different beds, the necessary supply of oxygen could enter between doses, was investigated, and the results made public property. This work, by the State of Massachusetts, was the foundation of the American system of intermittent filtration.

During this period of evolution in methods, inventions, aiming to cover the use and control of air in filters, were announced from time to time. The speaker has been compelled to believe that some of the alleged discoveries and inventions were not based on knowledge and reasonable experimentations so much as upon theory and desire to monopolize what appeared to be the coming system of sewage purification.

The evil of allowing fake systems to demonstrate their inefficiency at public expense, in preference to taking sound professional advice, has been obviated in Massachusetts by reason of the fact that plans must first be approved by the State Board of Health, whose standards of comparison afford no encouragement, but rather keep the promoter away.

Passing quickly on, experience soon proved that rates of sewage purification by sand filtration depended upon the size of the sand grains, and on the fact that, owing to the fineness of the material, the bacterial action was limited to the upper few inches of the filter; and also that the principal difficulty was found in handling the suspended matters in the sewage. Where fresh sewage was applied, fats and

Mr. Snow. fæcal matter accumulated on the surface of the filter, requiring frequent raking off; where stale sewage was applied, the surface deposits were found to be less and the fatty matters more easily handled.

The great question was the sludge problem: Was it better to separate the sludge from the body of the sewage, and press it, or separate it and apply it to particular beds, or indiscriminately apply it mixed with sewage?

Contemporaneous with these experiences, various patents for handling and disposing of this material were allowed. The most noted contrivance for this purpose is the septic tank. The proprietary right to this system will not be generally conceded in this country, unless sustained in the courts. The reason is, that the process is simply an extension of the action which has long been recognized as naturally taking place in sewage when it becomes stale. The tank is primarily a settling basin. The subsided matters putrefy and give off gases which raise the solids to the surface, where the gases escape and the solids fall to the bottom again, and the rise and fall continue until the solids pass into liquid form through bacterial action. The process is natural. It may be facilitated or hindered. The exclusive right to the natural process may well be questioned. The validity of patents issued for appliances to facilitate the action is not questioned, except in particular cases. Such appliances, placed for general sale, may be included in the engineer's design, and their use safeguarded under terms suggested by ordinary business methods. But it seems that the tank itself, and combinations with machinery or contrivances for automatically governing the same, cannot be used without liability of litigation.

At least one royalty has been paid in this country for the use of the septic process. The engineer who designed the works has sounded an alarm, and a similar payment will be more difficult to obtain hereafter. The case cited affords an example of what an alleged infringer may be willing to do to avoid annoyance, even where the validity of the claim is denied.

It is interesting to consider the claims of the much-discussed "Glover System" of sewage purification. No one has ever been able to tell just what Mr. Amasa Glover, of Brockton, Mass., did invent or discover, and patent. He claimed everything in sight, as the science was developed from year to year. Whether or not Mr. Glover did sufficiently and properly describe his invention, in the specification which was originally filed in the patent office, is immaterial to this discussion. The speaker can testify that Mr. Glover did claim an absolute disappearance of all solids either in the central tank of the system, or the subsequent filters grouped around the tank. He recognized the necessity of oxidation, and provided for a kind of aeration of the filters and also for periods of dosing and rest. Later, when the Massachusetts

State Board of Health began experiments on sands, Mr. Glover seriously considered bringing suit for infringement, until he found out that this could not be done. Subsequently, he decided that the experiments confirmed his claims, and it is a fact that, on the strength of the State Reports, men purchased stock in his company. The patent has long since expired, but there are scores of men living who will testify that Mr. Glover discovered the bacterial system of purification, and, owing to this fact, they were induced to invest money in the process. Mr. Snow.

The speaker does not wish to be understood as confirming in any way this opinion, but he is stating the facts, as he knows them, of this particular claim to the discovery of the septic and bacterial processes.

The date of that patent was 1882, or, perhaps, as early as 1880. In any event, it expired several years ago.

At the present time the best information regarding the preliminary decomposition of the organic compounds in sewage, especially the breaking down of cellulose and fatty matters, is that it must be by anaerobic liquefaction and hydrolysis. The subsequent purification must be aerobic, and, along these lines of oxidizing treatment, progress has been made in the use of filters of coarse material and gates to hold the sewage in contact with the bedding material for stated periods. In this manner the field of bacterial action is extended through the entire depth of the filter, and higher rates are thereby secured. This step has brought out another distinct class of inventions. Patent rights are now claimed on devices for controlling the septic action, and combinations with various kinds of filters, on the filters, sedimentation tanks, and various contrivances and appliances for controlling, distributing, and collecting sewage in its passage through the different stages of the purification works.

Some of these rights are owned by companies organized for the purpose of constructing disposal works. New companies are being organized for this purpose. In every instance patents are the basis for the enterprise. The great field of sewage purification offers inducements to capital, and any plausible scheme to create a monopoly of the business can find financial backing. It is with sewage disposal companies owning patented processes that the engineer will be brought in contact more frequently in the future.

Now, contracts awarded on plans and specifications furnished by each bidder have been held to be illegal, because the law implies a common standard upon which bids shall be compared. As any other method would be contrary to the policy of law and good government, it is usually held that a city must prepare its own plans and specifications, and all patented processes constituting the subject of a monopoly must be excluded from the plans. This law, or this interpretation of the law, if strictly carried out, would prevent many useful appliances and inventions being used on public works, which, in itself, would be

Mr. Snow. poor public policy. The speaker considers a disposal plant to be like a machine, or anything complete in itself, operating to perform a stated amount of work in a stated time and manner, and, when considered in this light, it is a subject for proposal and contract just as much as a pumping engine, steam-boiler, or any other contrivance which can be constructed and set up ready for use by a contractor.

If this be so, sewage disposal companies owning patents will be encouraged to struggle for existence. Proprietary systems will be offered to municipalities, and, in evidence of good faith, promoters will agree to execute satisfactory bonds in almost any amount that the claim for the system shall be obtained.

Such propositions demand consideration, and in time they reach the engineer. Even three years ago he did not have to consider to any extent the utility and validity of patents and proprietary systems, but there is no question now about the necessity of a comprehensive knowledge of these matters.

In conclusion, the speaker does not believe that the threatened suits, referred to at the beginning of these remarks, will ever be brought to trial, but if forced into litigation, he will enter the contest with the assurance of extended co-operation on the part of engineers, and with full confidence as to the final results.

Mr. Hering. RUDOLPH HERING, M. Am. Soc. C. E.—The author has done a commendable service in bringing together this material and putting it in good shape for reference, as it will materially help all those engineers who are interested in this particular subject.

The speaker's impression is that Mr. Philbrick constructed his tanks and sewage disposal plants somewhat earlier than 1883, the date given in the paper. During the eighties, the speaker built two plants, each for the disposal of 20 000 galls. a day, practically on Mr. Philbrick's suggestions. One of these plants was near Philadelphia, the other was for a hotel on an island in Lake George. The experience was very interesting in more than one way. The latter plant was put up early in the spring, before the hotel was opened, and at the end of the season there were several things that surprised him, and for which he did not find an explanation until recently, when the septic tank process became common knowledge.

Mr. Philbrick suggested two settling tanks, into which the sewage first entered, dropping its heavier matter to the bottom and suspending the lighter matter at the surface, this being the ostensible object of these two tanks, which were to be used alternately. The liquid between the two layers of solid matter was, by means of a submerged outlet, passed into another chamber which was the siphon tank. From the latter, whenever the tank was full, the sewage, with almost no suspended matter, was discharged automatically into the pipe delivering it upon the prepared surface of land, where it was absorbed by the

sandy soil. At the end of the summer the speaker was surprised to see so little deposit in one of the tanks, and to learn that the other one had not been used at all, because it had not been necessary. The second one was to be used only when the accumulation of deposits in the first interfered with the natural separation, and required removal. This settling tank was about 20 ft. in diameter, and there was a deposit of about 6 ins. or 1 ft. of sludge and a scum of 2 or 3 ft. It was said that this had been the condition for several months. The speaker could not understand at that time why the scum and deposit increased rapidly at first and then practically remained constant, although the quantity of sewage was greater rather than less. The reason is now known. Mr. Hering.

It seems to the speaker that this tank was practically the same as that which is now called the septic tank. Mr. Philbrick, and also a Mr. Barrett, of Staten Island, had built a number of them.

In 1880 the speaker had the privilege of meeting Mr. Rogers Field, who invented the first practical automatic siphon for sewage discharge. He showed him, at his office in London, the application of this siphon to the disposal of the sewage from country residences, with the same arrangements that Mr. Philbrick published in his little pamphlet.

GEORGE W. RAFTER, M. Am. Soc. C. E. (by letter).—The writer can contribute, to the list cited by Mr. Metcalf, a brief description of a septic tank which has been in use since 1889 or 1890 at the old Colony of Manhattan State Hospital, at Central Islip, N. Y. Its capacity is about 80 000 galls. or sufficient to take nearly the entire day's flow. It is underground, arched over, and thus entirely covered, entrance to it being effected through manholes. The contents are pumped out upon land in about 5 hours. There are no plans, and its exact dimensions are unknown to the writer. The sludge is removed twice each year. Mr. Rafter.

JAMES OWEN, M. Am. Soc. C. E.—The speaker can corroborate Mr. Hering's statements as to the early use of Mr. Philbrick's design for closed tanks, as outlined by the author. About the year 1882, and for some years after, the speaker constructed a number of small sewage disposal plants upon Mr. Philbrick's design, and he was surprised to find out how small was the deposit in the bottom, and how little the accumulation of scum on top, in tanks which had not been cared for. Mr. Philbrick designed these tanks to be systematically cared for, by having the top scum removed periodically. In one particular case, no care had been taken with the plant, and, four years after, it was found on examination that the surface accumulation was very small (about 1 ft.), and that the bottom deposit was less than that, showing that the septic action, which is now recognized, was going on, but was then an unknown factor. Mr. Owen.

Referring to the main point of discussion in the paper, relative to

patent rights, about the years 1885 or 1886, a notice from a lawyer was received by the speaker, stating that he was infringing on Mr. Waring's patent by using the subsoil irrigation system for the disposal of sewage, and it was a great surprise to him, as he had received his early education from an entirely different source, viz., Mr. Philbrick, and as he had never read Mr. Waring's book on the subject, and did not know that Mr. Waring had any patents upon the system. The claim was never pressed, nor was any royalty ever paid.

In regard to the septic tank, the speaker entirely agrees with Mr. Snow, that the knowledge of patents on ordinary engineering structures is a great detriment to the furtherance of such construction by clients who may desire to have them, on account of the dread of lawsuits to which they are liable by the use of a patented article or system, whether the patent is or is not really valid. The septic tank, as originally worked out by Mr. Cameron, was a purely professional design, and he never had a patent on the septic tank principle, but only on the distributing arrangement, which was a purely mechanical device. In this country, however, patents have been granted on the septic principle of the decomposition of sewage, which is really a natural process, guided, of course, by special conditions.

About four years ago the speaker designed and constructed a septic tank having a capacity of about 40 000 galls., and based on Mr. Cameron's idea of the Exeter tank. No plans of the Exeter work were available, and the speaker evolved the construction of his tank from his own ideas of the general requirements for such work. Shortly after the completion of the work a letter was received from a gentleman in Chicago stating that he was interested in the septic tank principle, and desired to see the tank. A favorable answer was sent to this gentleman, the inspection was duly made, and no claim of any patent rights was made at that time. Last year the speaker constructed another septic tank, of about the same capacity, description of which was current in the professional papers, and a notice was sent to him from a Chicago syndicate claiming damages for the infringement of a patent. The claim being repudiated by the speaker, the representative of the syndicate—the same person who originally claimed to be interested in septic tanks—appeared on the scene. After a free discussion of the question, it appeared that the particular patent for septic tanks was issued to the syndicate about six months after the completion of the first tank constructed by the speaker, and the interview closed with a positive intimation on the part of the speaker that he would repudiate any claims for the infringement of the so-called patent. It is very doubtful, in the speaker's mind, whether any patent for septic tanks issued in this country has any validity whatever.

The tank at Champaign, Ill., was constructed before either of the speaker's tanks was commenced. It was practically contemporaneous

with the Exeter tank, and they both emanated from the investigations of the Massachusetts State Board of Health. Mr. Owen.

The speaker is somewhat solicitous about the patent question. In his opinion, it is entirely unprofessional for a civil engineer to get any patent on any work which he has constructed. If an engineer, in exercising his professional function on behalf of his client, should design something novel or new, it does not belong to him, but to his client, and, with a due regard for the proper professional standard, he cannot use it. If he has obtained a patent on work or construction which he has designed outside his professional capacity, he is practically debarred from using it himself, because he has an ownership and an interest in a merchantable article, in the use of which he is debarred by the ethics of his profession.

The speaker wishes to lay down the law very strongly on this patent question, as there is a prevalent idea, especially among the younger members of the profession, that if a professional engineer gets up a new design which has especial merits, it is perfectly proper for him to patent it. The speaker believes that such an act is entirely unprofessional.

Leonard Metcalf, Assoc. M. Am. Soc. C. E. (by letter).—Mr. Snow, in his interesting discussion, has stated that, "It has not been made clear what disposition of the sediment was intended," in the tanks illustrated. The writer had not considered that point as germane to the subject. To clear up any doubts, however, it may be said that the same general methods of disposal were made use of that are to be found to-day. Mr. Metcalf.

Thus, in Henry Austin's plan, the sludge was composted with ashes and used for fertilizing purposes. At the Derbyshire School it was pumped out and distributed on land. The sludge of the Paris tanks was pumped out into tight receptacles, carried to central stations, and from them pumped to large sludge beds in the suburbs, which beds were underdrained like filter beds. The sludge was thus drained underneath and dried out by the air. In most of the other plants, composting, followed by disposal upon land, was the common method of treatment. In the chemical precipitation plants, of course, sludge presses were used.

The writer would confirm Mr. Hering's "impression * * * that Mr. Philbrick constructed his tanks and sewage disposal plants somewhat earlier than 1883," by stating that he has been informed from other sources that such is the case. The writer's only reason for adopting the date 1883 was that the latter was the date upon which Mr. Philbrick published in an engineering magazine a technical article upon the subject, thus giving public expression to his views and making them a matter of "common knowledge."

A few additional examples of early tanks have been brought to the writer's attention by C. C. Brown, M. Am. Soc. C. E.

Mr. Metcalf. The first is a small disposal plant built upon the chemical precipitation system, designed by Mr. Brown for Stamford, N. Y. At the time that this tank was built Mr. Brown was of the opinion that the entire plant was not necessary, and he therefore recommended the construction of the sedimentation tanks only, with the addition of some baffle-boards to prevent a direct surface current. The tank was covered with a plank roof. Mr. Brown says of it:

"This was really accidentally a septic tank; when I visited the town one or two years after it was constructed, the action of the tank was reported to be satisfactory."

The second plant referred to by Mr. Brown was that at Round Lake, N. Y., which was originally run as a chemical plant, but which has also been operated to a considerable extent, as what would now be termed a septic tank. The Soldiers' Home, at Bath, and the plant at Mt. Vernon also make some approach to this system. The Institution for the Blind, at Batavia, N. Y., which has one of the German upward filtration plants, was also modified somewhat, and made to approach more nearly the septic tank arrangement.

In regard to these examples, Mr. Brown says:

"None of these tanks, with the exception of the first two, could be classed as a septic tank, strictly speaking, and none of them was constructed as a septic tank."

Mr. Owen's remarks upon the patent question are most timely ,and are heartily subscribed to by the writer. The latter felt, in presenting his paper, that a broader question than that indicated by the title was really involved, namely, the attitude of the engineering profession upon the question of the patenting of the methods and devices used in any engineering works by their designing engineer.

It is, perhaps, a question of legal rights *versus* moral rights or expediency. No one would question the right of the inventor to government protection and to the legitimate enjoyment and benefit of his discovery; yet, on the other hand, it is often hard to draw the line between true originality or novelty of design and mere adaptation to the problem in hand of the knowledge and discovery of others. This appears to be particularly true in the field of sanitary science, which has seen such marked advance in the past decade. Who, for instance, can say how far reaching have been the results obtained by the Massachusetts State Board of Health in their influence upon the later developments in the bacterial treatment of sewage?

The United States and Germany are the only countries in which a thorough search of records is made before granting patent rights. In Great Britain and her colonial possessions; in France, and in other countries, no assurance is implied in the granting of patent rights that the patent has not been anticipated. In the United States, however, an examination is made, not only of the specifications of the United

States, but also of those of foreign countries, and the scrutiny is extended to general scientific literature. Mr. Metcalf.

Therefore the granting of patents in this country gives to claims an authority—bearing in mind the limitations of the patent office and the fact that existing plants frequently fail of notice in engineering journals—which the premises sometimes do not warrant. Yet this authority is often sufficient to prevent the adoption of proposed engineering plans by municipalities on account of fear of subsequent, or sometimes threatened, litigation.

From the point of view, therefore, of professional interests, not less than of the advancement of science, it would be most unfortunate were American engineers to outgrow their old objection, or perhaps prejudice, to the patenting of new or improved engineering methods and devices, and to adopt the English system of wholesale patenting. Mr. Owen has presented the case, from the standpoint of professional ethics, in a clear and forcible manner.